

What is claimed is:

1           1.     A method for closed loop power control in a wireless communication  
2 network, comprising:  
3           despreading a received signal;  
4           estimating the signal power of the despread received signal;  
5           estimating the noise power of the despread received signal, estimating the  
6 noise power including:  
7                     multiplying the despread received signal with an orthogonal noise code  
8 to cancel the received signal; and  
9                     accumulating the multiplied despread received signal over one frame;  
10           determining a signal-to-noise ratio of the received signal at least in part by  
11 dividing the estimated signal power by the estimated noise power; and  
12           determining a reverse power control bit based on the determined signal-to-  
13 noise ratio.

1           2.     The method according to Claim 1, wherein the determined reverse  
2 power control bit corresponds to a power down command if the determined signal-to-  
3 noise ratio is above a predetermined threshold and wherein the determined reverse  
4 power control bit corresponds to a power up command if the determined signal-to-  
5 noise ratio is not above the predetermined threshold.

1           3.     The method according to Claim 1, wherein the orthogonal noise code is  
2 a Walsh code.

1           4.     The method according to Claim 3, wherein the Walsh code is a thirty-  
2 two bit code in which the most significant sixteen bits are ones and the least  
3 significant sixteen bits are zeros.

1           5.     The method according to Claim 1, wherein the despread received signal  
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of  
3 the despread received signal is comprised of:

4                 obtaining a forward power control bit by decoding the despread received  
5 signal;

6                 for each of the plurality of Rake fingers:

7                     multiplying the decoded forward power control bit with at least one  
8 forward power control bit portion;

9                     determining the position of the reverse power control bit;

10                    selecting the despread received signal of the corresponding Rake finger  
11 for a duration of one power control group;

12                    accumulating the received despread signal to eliminate all data channel  
13 signals except a pilot signal to create a decimated pilot signal;

14                    multiplying the decimated pilot signal with a complex conjugate of a  
15 delayed version of the decimated pilot signal to obtain a multiplied result;

16 accumulating a real component of the multiplied result over one power  
17 control group to obtain a Rake finger output; and  
18 determining the signal power estimate by coherently combining and averaging  
19 the plurality of Rake finger outputs.

1 6. The method according to Claim 2, further comprising puncturing the  
2 determined reverse power control bit into power control group data corresponding to  
3 a power control group.

4 7. The method according to Claim 6, wherein puncturing the determined  
5 reverse power control bit comprises:

6 buffering control group data corresponding to a plurality of power control  
7 groups, the determined reverse power control bit being punctured into each of the  
8 power control group data corresponding to the plurality of power control groups; and

9 updating the buffered control group data each time a reverse power control bit  
10 is determined.

1 8. The method according to Claim 7, wherein the reverse power control bit  
2 is determined two times per power control group.

1 9. The method according to Claim 6, wherein puncturing the determined  
2 reverse power control bit comprises:

3 using a first quantity of symbols in each power control group to determine a  
 4 first signal power estimate;  
 5 determining a first power control bit based on the first signal power estimate;  
 6 puncturing the first power control bit into the  $n+2$  power control group  
 7 wherein  $n$  corresponds to a predetermined power control group;  
 8 using a second quantity of symbols in each power control group to determine a  
 9 second signal power estimate;  
 10 determining a second power control bit based on the second signal power  
 11 estimate; and  
 12 replacing the punctured first power control bit with the second power control  
 13 bit if a power control bit position in the  $n+2$  power control group is after the second  
 14 quantity of symbols in a current reverse link power control group.

1 10. The method according to Claim 9, wherein the first quantity of symbols  
 2 corresponds to a first four symbols in a power control group and wherein the second  
 3 quantity of symbols corresponds to six symbols in the power control group.

1 11. The method according to Claim 10, wherein the symbols are Walsh  
 2 symbols.

1 12. The method according to Claim 11, wherein the punctured power  
 2 control bit is determined two times per power control group.

1           13.    The method according to Claim 1, wherein the despread received signal  
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of  
3 the despread received signal is comprised of:

4           for each of the plurality of Rake fingers:

5                 coherently accumulating the despread received signal;

6                 taking a squared amplitude over a time of the coherent accumulation to  
7 determine a finger signal power level within one-half of a power control group;

8                 summing the finger signal power levels for all of the plurality of Rake fingers  
9 together over one-half of the power control group to determine an intermediate signal  
10 power estimate; and

11                 adding the intermediate signal power estimate to a previous signal power  
12 estimate.

1           14.    The method according to Claim 13, wherein the despread received  
2 signal includes a non-gated pilot signal.

1           15.    The method according to Claim 1, wherein the despread received signal  
2 is arranged as a plurality of Rake fingers, and wherein estimating the signal power of  
3 the despread received signal is comprised of:

4           obtaining a forward power control bit by decoding the despread received  
5 signal;

for each of the plurality of Rake fingers:

- multiplying the decoded forward power control bit with at least one forward power control bit portion;
- determining the position of the reverse power control bit;
- selecting the despread received signal of the corresponding Rake finger for a duration of one-half power control group;
- accumulating the received despread signal to eliminate all data channel signals except a pilot signal to create a decimated pilot signal;
- multiplying the decimated pilot signal with a complex conjugate of a delayed version of the decimated pilot signal to obtain a multiplied result;
- accumulating a real component of the multiplied result over one-half power control group to obtain a finger signal power level;
- summing the finger signal power levels for all of the plurality of Rake fingers together over one-half of the power control group to determine an intermediate signal power estimate; and
- adding the intermediate signal power estimate to a previous signal power estimate.

16. A method for estimating a power level for a despread wireless communication signal having a non-gated pilot signal, the despread received signal being arranged as a plurality of Rake fingers, the method comprised of:

obtaining a forward power control bit by decoding the despread received  
signal;  
for each of the plurality of Rake fingers:  
multiplying the decoded forward power control bit with at least one  
forward power control bit portion;  
determining the position of the reverse power control bit;  
selecting the despread received signal of the corresponding Rake finger  
for a duration of one power control group;  
accumulating the received despread signal to eliminate all data channel  
signals except a pilot signal to create a decimated pilot signal;  
multiplying the decimated pilot signal with a complex conjugate of a  
delayed version of the decimated pilot signal to obtain a multiplied result;  
accumulating a real component of the multiplied result over one power  
control group to obtain a Rake finger output; and  
determining the signal power estimate by coherently combining and averaging  
the plurality of Rake finger outputs.

17. A method for estimating a power level for a despread wireless  
communication signal having a gated pilot signal, the despread received signal being  
arranged as a plurality of Rake fingers, the method comprised of:  
for each of the plurality of Rake fingers:  
coherently accumulating the despread received signal;

6 taking a squared amplitude over a time of the coherent accumulation to  
7 determine a finger signal power level within one-half of a power control group;  
8 summing the finger signal power levels for all of the plurality of Rake fingers  
9 together over one-half of the power control group to determine an intermediate signal  
10 power estimate; and  
11 adding the intermediate signal power estimate to a previous signal power  
12 estimate.

1 18. A system for closed loop power control in a wireless communication  
2 network, comprising:

3 a communication unit having:

4 a receiver, the receiver receiving a first signal;

5 a central processing unit, the central processing unit in operative  
6 communication with the receiver and executing functions including:

7 despread the received first signal;

8 estimating the signal power of the despread received first signal;

9 estimating the noise power of the despread received first signal,

10 estimating the noise power including:

11 multiplying the despread received signal with an  
12 orthogonal noise code to cancel the received first signal; and

13 accumulating the multiplied despread received first signal  
14 over one frame;



15 determining a signal-to-noise ratio of the received first signal at  
16 least in part by dividing the estimated signal power by the estimated noise power; and  
17 determining a reverse power control bit based on the determined  
18 signal-to-noise ratio.

1 19. The system according to Claim 18, wherein the central processing unit  
2 further performs the function of punching the determined reverse power control bit  
3 into a second signal.

20. The system according to Claim 19, further including a device, wherein  
the communication unit further includes a transmitter in operative communication  
with the central processing unit, the transmitter transmitting the second signal to the  
device using the wireless communication network.

1 21. The system according to Claim 18, wherein the determined reverse  
2 power control bit corresponds to a power down command if the determined signal-to-  
3 noise ratio is above a predetermined threshold and wherein the determined reverse  
4 power control bit corresponds to a power up command if the determined signal-to-  
5 noise ratio is not above the predetermined threshold.

1 22. The system according to Claim 18, wherein the orthogonal noise code is  
2 a Walsh code.

1           23.    The system according to Claim 22, wherein the Walsh code is a thirty-  
2   two bit code in which the most significant sixteen bits are ones and the least  
3   significant sixteen bits are zeros.

1           24.    The system according to Claim 18, wherein the despread received first  
2   signal is arranged as a plurality of Rake fingers, and wherein estimating the signal  
3   power of the despread received first signal is comprised of:

4           obtaining a forward power control bit by decoding the despread received first  
5   signal;

6           for each of the plurality of Rake fingers:

7                 multiplying the decoded forward power control bit with at least one  
8   forward power control bit portion;

9                 determining the position of the reverse power control bit;

10                selecting the despread received signal of the corresponding Rake finger  
11   for a duration of one power control group;

12                accumulating the received despread signal to eliminate all data channel  
13   signals except a pilot signal to create a decimated pilot signal;

14                multiplying the decimated pilot signal with a complex conjugate of a  
15   delayed version of the decimated pilot signal to obtain a multiplied result;

16                accumulating a real component of the multiplied result over one power  
17   control group to obtain a Rake finger output; and

18 determining the signal power estimate by coherently combining and averaging  
19 the plurality of Rake finger outputs.

1 25. The system according to Claim 21, wherein the central processing unit  
2 further executes the function of puncturing the determined reverse power control bit  
3 into power control group data corresponding to a power control group.

1 26. The system according to Claim 25, wherein puncturing the determined  
reverse power control bit comprises:

buffering control group data corresponding to a plurality of power control  
groups, the determined reverse power control bit being punctured into each of the  
power control group data corresponding to the plurality of power control groups; and  
updating the buffered control group data each time a reverse power control bit  
is determined.

1 27. The system according to Claim 26, wherein the reverse power control  
2 bit is determined two times per power control group.

1 28. The system according to Claim 25, wherein puncturing the determined  
2 reverse power control bit comprises:

3 using a first quantity of symbols in each power control group to determine a  
4 first signal power estimate;

5 determining a first power control bit based on the first signal power estimate;

6 puncturing the first power control bit into the  $n+2$  power control group  
7 wherein  $n$  corresponds to a predetermined power control group;  
8 using a second quantity of symbols in each power control group to determine a  
9 second signal power estimate;  
10 determining a second power control bit based on the second signal power  
11 estimate; and  
12 replacing the punctured first power control bit with the second power control  
13 bit if a power control bit position in the  $n+2$  power control group is after the second  
14 quantity of symbols in a current reverse link power control group.

29. The system according to Claim 28, wherein the first quantity of symbols  
corresponds to a first four symbols in a power control group and wherein the second  
quantity of symbols corresponds to six symbols in the power control group.

30. The system according to Claim 29, wherein the symbols are Walsh  
symbols.

31. The system according to Claim 30, wherein the punctured power control  
bit is determined two times per power control group.

32. The system according to Claim 18, wherein the despread received first  
signal is arranged as a plurality of Rake fingers, and wherein estimating the signal  
power of the despread received first signal is comprised of:

4 for each of the plurality of Rake fingers:  
5 coherently accumulating the despread received first signal;  
6 taking a squared amplitude over a time of the coherent accumulation to  
7 determine a finger signal power level within one-half of a power control group;  
8 summing the finger signal power levels for all of the plurality of Rake fingers  
9 together over one-half of the power control group to determine an intermediate signal  
10 power estimate; and  
11 adding the intermediate signal power estimate to a previous signal power  
12 estimate.

33. The system according to Claim 32, wherein the despread received first  
13 signal includes a non-gated pilot signal.

34. The system according to Claim 18, wherein the despread received first  
14 signal is arranged as a plurality of Rake fingers, and wherein estimating the signal  
15 power of the despread received first signal is comprised of:

16 obtaining a forward power control bit by decoding the despread received first  
17 signal;

18 for each of the plurality of Rake fingers:

19 multiplying the decoded forward power control bit with at least one  
20 forward power control bit portion;

21 determining the position of the reverse power control bit;

selecting the despread received first signal of the corresponding Rake  
finger for a duration of one-half power control group;

accumulating the received despread first signal to eliminate all data  
channel signals except a pilot signal to create a decimated pilot signal;

multiplying the decimated pilot signal with a complex conjugate of a  
delayed version of the decimated pilot signal to obtain a multiplied result;

accumulating a real component of the multiplied result over one-half  
power control group to obtain a finger signal power level;

summing the finger signal power levels for all of the plurality of Rake fingers  
together over one-half of the power control group to determine an intermediate signal  
power estimate; and

adding the intermediate signal power estimate to a previous signal power  
estimate.